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XRBcats: Galactic Low Mass X-ray Binary Catalogue⋆

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ABSTRACT

We present a new catalogue of low-mass X-ray binaries (LMXBs) in the Galaxy. The catalogue contains source names, coordinates, source types, fluxes, distances, system parameters, and other characteristic properties of 348 LMXBs, including LMXBs that were newly discovered or re-classified since the latest releases of the catalogues by Liu et al. (2007) and Ritter & Kolb (2003). The aim of this catalogue is to provide a list of all currently known Galactic objects identified as LMXBs with some basic information on each system (including X-ray and optical/IR properties where possible). Literature published before March 2023 has, as far as possible, been taken into account when compiling this information. References for all reported properties as well as object finding charts in several energy bands are provided as part of the catalogue. We plan to update the catalogue regularly, in particular to reflect new objects discovered in the ongoing large scale surveys such as *Gaia* and *eROSITA*.

Key words. catalogues – binaries: close – stars: late-type – X-rays: binaries

1. Introduction

X-ray binaries (XRBs) are among the brightest objects in the sky in the X-rays. They represent endpoints of stellar evolution of massive stars. Understanding physical processes defining the observational appearance of individual objects and properties of the XRB population as a whole is thus essential for understanding massive star evolution and evolution of the Galaxy in general. It is important, therefore, to keep the up-to date census of known XRBs and their properties, especially in the era of current generation large-scale surveys like the extended ROentgen Survey Imaging Telescope Array (*eROSITA*, Merloni et al. 2012; Predehl et al. 2021) onboard SRG, *Gaia* (Gaia Collaboration et al. 2016b; Gaia Collaboration 2022) and Wide-field Infrared Survey Explorer (*WISE*, Wright et al. 2010; Cutri et al. 2021) which allow for the possibility to discover ever fainter objects and provide a wealth of observational information for the entire sky. Identification of XRBs among millions of other objects requires, however, knowledge of properties and locations of already known objects. The compilation of such an updated database is the primary goal of this work although many other uses can of course also be envisaged.

The main source of high-energy radiation in XRBs is accretion of matter onto either a neutron star (NS) or a black hole (BH) from a companion star. The observed properties of XRBs are largely defined by the mass transfer mechanism powering the accretion, which can occur either directly from wind of a secondary or via Roche lobe overflow (RLOF), which primarily depends on the mass ratio of the compact object and the optical counterpart (M_x/M_{opt}). Based on this ratio, XRBs are subdivided into two large groups: high and low mass X-ray binaries (HMXBs and LMXBs, respectively). For objects with $M_x > M_{opt}$; $M_{opt} \lesssim 1M_\odot$ the mass is transferred to the compact object via RLOF. Such objects are classified as LMXBs. Those with $M_x < M_{opt}$; $M_{opt} \gtrsim 5M_\odot$ typically accrete directly from the stellar wind and are classified as HMXBs. The rather dramatic differences in the observed properties of LMXBs and HMXBs warrant treatment of each sub-class separately. Here, we focus on the properties of LMXBs. An updated catalogue of HMXBs is presented by Neumann et al. (2023).

As follows from the definition of an LMXB, the donor is (in most cases) a late spectral type star filling its Roche lobe. A-type stars, F-G-type subgiants, or even white dwarfs (WDs), however, can also act as donors in LMXBs. The optical properties of LMXBs can also be affected by emission from the accretion disc around the compact object, where the disc can be heated by itself or illuminated by X-ray emission from the compact object. Nevertheless, LMXBs are generally intrinsically faint objects in the optical and IR bands. The main way to analyse features of known LMXBs in detail or detect new ones is to observe them during outbursts (Lasota 2016). Thus, new sources continue to be discovered and the population of known LMXBs is ever growing.

The most recent catalogue of Galactic LMXBs was published 15 years ago by Liu et al. (2007). Since this time many new transient and persistent objects have been discovered. Some LMXB candidates have been reclassified while other sources have gained LMXB status. More importantly, a wealth of additional observational data have been collected with new facilities such as the X-ray Multi-Mirror Mission (*XMM-Newton*, Jansen et al. 2001), the INTErnational Gamma-Ray Astrophysics Laboratory (*INTEGRAL*, Winkler et al. 1993) or *Gaia*. Here we present an updated catalogue of the Galactic LMXBs including this multi-wavelength information as well as adding new sources discovered since the publications by Liu et al. (2007) and Ritter & Kolb 2003 (Liu07 and RK03 hereinafter). Our final catalogue contains 348 LMXBs

⋆ A web-version is publicly accessible at `http://astro.uni-tuebingen.de/~xrbcat/` and at CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via `http://cdsarc.u-strasbg.fr/viz-bin/cat/J/A+A/vol/pag`

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and candidates, of which 204 were contained in the two catalogues mentioned above (the content of Liu07 and RK03 overlaps but neither includes the other completely). That is, the new catalogue presented here represents a more than 70% increase in volume with respect to the two most extensive catalogues of the past. We made an effort to collect all relevant and up-to date multiwavelength information including distances, optical magnitudes, variability in soft and hard X-rays, and more so that the catalogue can be useful in identification of new LMXBs in ongoing and future X-ray surveys, and population studies.

The structure of the paper is as follows: in Sect. 2 we describe how the LMXBs sample was compiled and list data sources used to provide extra information on known objects. In the same section we list relevant X-ray and optical properties, and characterize methods used for identification of known and candidate optical/IR counterparts in large-scale surveys. In Sect. 3, the description of the table fields and finding charts is provided, as well as the comparison of our catalogue with works of RK03 and Liu07. Finally, we summarize our results in Sect. 4. One can also find the list of identified archive optical/IR counterparts for a bunch of LMXBs, based on literature in Appendix A. The description of the columns of the catalogue table is presented in Appendix B.

2. Definition of the sample and data sources

The bulk of the objects in the catalogue consists of LMXBs reported by the catalogues of RK03 and Liu07, so we started our compilation of the sample by merging these two catalogues. In this process a number of duplicate objects both within and across the two catalogues has been identified and removed from the sample. In addition, several sources in RK03 and Liu07 have been found to be extra-galactic (in some cases this possibility was already indicated in the original catalogues and sometimes reported in the literature afterwards). Such objects were also excluded from our final list. The same applies to the two known LMXBs that are located in nearby galaxies, i.e., in LMC X−2 and RX J0532.7−6926 which are located in LMC and were included in both RK03 and Liu07. All objects which were removed and otherwise problematic cases are listed and described in detail in Sect. 3.2.

In addition to Liu07 and RK03, we also considered all Galactic objects classified as possible LMXBs in the *SIMBAD*[1] and *VizieR*[2] databases hosted by the Centre de Données astronomiques de Strasbourg (CDS) databases. We include such objects in the catalogue giving appropriate references for classification. We also systematically searched the literature (including Astronomoner's Telegrams[3]) for reports of new LMXB discoveries. Most of the new LMXBs reported in the literature between 2006 and 2020 have been, in fact, discovered by the *INTEGRAL* (Winkler et al. 2003), *MAXI* (Matsuoka et al. 2009), *Swift* (Gehrels et al. 2004) or *Gaia* (Gaia Collaboration et al. 2016a) missions as summarised by Bahramian & Degenaar (2022). The latter publication can, therefore, also be considered as another major data source used in this work. It should be noted that although efforts have been made to find all LMXBs identified to date, it is still possible that we may have missed some objects or candidates, so we encourage the reader to report such omissions to the corresponding author so that those can be included in updated versions of the catalogue.

We note that systems in which a WD acts as an accretor are not generally considered as XRBs for historical reasons (despite the fact that they also emit in the X-ray band), so those systems (namely, cataclysmic variables or CVs) are not included in the current catalogue. We also do not include rotation-powered pulsars even if they are members of binary systems and emit in X-rays, unless the observed emission is accretion powered. That is, "spider"-type pulsars including Black Widows (BW) and Redbacks (RB; see, e.g., Chen et al. 2013; Roberts 2013) are omitted unless they are also classified as transitional milliseconds pulsars (tMSP; see, e.g., Archibald et al. 2009; Papitto et al. 2013; Knight et al. 2023). All tMSPs and their candidates included in the catalogue are listed in Table 1 in Sect. 3.2.

The masses quoted above for LMXBs/HMXBs are of course approximate, and there are some boundary cases such as Her X−1 where accretion to a NS occurs via the RLOF of a B3 type $\sim 2.2 M_{\odot}$ donor (Tananbaum et al. 1972; Middleditch & Nelson 1976). This system is most often classified in the literature as an intermediate mass X-ray binary (IMXB) rather than as an LMXB because the NS appears as an X-ray pulsar and thus is strongly magnetized, which is not typical for NS LMXBs. On the other hand, another system 4U 1543−47 with an intermediate mass ($2.5 M_{\odot}$) A2V type donor with accretion occurring via RLOF to a black hole ($M_{\rm x} = 9.4 M_{\odot}$), is most often classified LMXB (Chevalier & Ilovaisky 1992; Orosz et al. 1998, 2002), so the lines are vague here. Since the total number of IMXBs is relatively small, and on top of that, although they 'bridge' the HMXB and LMXB classes, they are evolutionarily closer to LMXBs as binary systems, so we opted to include them as part of the current LMXB catalogue. This decision is also clearly communicated in the publication describing the HMXB catalogue released in parallel to the current work (Neumann et al. 2023) to avoid any confusion and sources duplication, except one specific case (Cir X−1) described in Sect. 3.2.

2.1. Main properties and features

In order to reflect the huge variety of LMXB properties, we include available information on properties of the donor star and compact object, as well as variability and other relevant information. Besides the quantitative properties (such as positions, fluxes in various bands, orbital or spin periods and so on), some of these properties or features can be incorporated as a set of flags defined to characterize several LMXB sub-classes, as was already done by Liu07 and RK03. Here we extend the classification adopted by these authors to account for extra features added to the current catalogue. To give a broad overview for the sample of known LMXBs in the Galaxy, the frequency of occurrence of individual flags is provided along with flag description below (in brackets) and also presented in graphical form in Fig. 1. Note that the flags below are not meant as a basis for a systematic classification but rather simply reflect properties of individual systems to simplify selection of objects exhibiting certain observational features. Each of the sources in the catalogue might have, therefore, one or several of the flags listed below in alphabetical order:

1. AS: atoll X-ray binary hosting a weakly magnetized neutron star as a main component, the spectrum is soft and no significant pulsations are present. The majority of the points on the color-color diagrams ("hard" versus "soft") from atoll sources usually form a band at constant hard color.
2. BH: system contains a black hole candidate.
3. BO: X-ray burster (see XB definition below) with coherent burst oscillations at the neutron star spin period.
4. DC: system with an accretion disc corona.
5. DS: "dipping" source. System shows periodic, irregular dips in the X-ray intensity, which are generally connected with the

[1] http://simbad.cds.unistra.fr/simbad/
[2] https://vizier.cds.unistra.fr/viz-bin/VizieR
[3] https://astronomerstelegram.org/

partial obscuration of the neutron star by a thickened region of the accretion disc.
6. EB: eclipsing or partially eclipsing binary system.
7. GC: source within a globular cluster.
8. MQ: microquasar, a source with reported evidence for relativistic jets.
9. NSH: negative (nodal) superhumps are present in the system. These negative superhumps are a periodic optical signals whose periods are smaller than the orbital period of the binary.
10. QNS: quiescent neutron star.
11. RP: compact object acts as a radio pulsar.
12. PSH: positive superhumps (permanent or transient) present in the system. The same as the NS type (see above), but the time period of the signal is larger than the orbital one.
13. XB: X-ray burst source. This type collects X-ray binary systems with a neutron star, which are showing periodic increases in luminosity.
14. XP: compact object in the binary acts as an X-ray pulsar.
15. XT: transient X-ray source. System shows dramatic changes in luminosity (mostly in the X-ray band). Energy is produced by means of a non-stationary accretion process.
16. US: ultra-soft X-ray spectrum. In some catalogues this type is denoted as super soft. These binaries also include some "extreme ultra-soft" (EUS) sources.
17. ZS: Z-type source. This type of the X-ray binary is similar to atoll one (also contains weakly magnetized neutron star), but the plot on the color-color diagram is different (Z-letter shape).

2.2. X-ray properties

Considering that X-ray emission dominates the bolometric luminosity of XRBs, one of their main characteristics is their X-ray flux and spectrum. In the catalogue, we tried, therefore, to compile in a uniform way information on X-ray fluxes in soft and hard X-ray bands for all LMXBs. For the soft X-ray band we report fluxes observed by *XMM-Newton*[4](Schartel et al. 2022; Webb et al. 2020), the Chandra X-ray Observatory[5](*CXO*, Weisskopf et al. 2000; Evans et al. 2010), and *Swift*/XRT[6](Burrows et al. 2005; Evans et al. 2020) throughout their lifetime. In particular, we report the flux in the 0.2–12 keV energy band (corresponding to EPIC_8 band of *XMM-Newton* catalogues) and similar energy bands of *CXO* and *Swift*/XRT, i.e., the 0.3–10 keV observed flux for *Swift*/XRT, whereas for *CXO*, either the broad ACIS band (0.5–7.0 keV) or the wide HRC band (0.1–10.0 keV) were used. Note that although the difference in energy bands for various instruments might result in a factor of ∼1.5 difference for a given same source, here we only report the range of fluxes detected over a long period, and this range is dominated by intrinsic variability and differences in source spectra, so for our purposes the difference in energy ranges of various instruments is not really relevant. In the hard X-ray band fluxes from *INTEGRAL*[7](Krivonos et al. 2012) and *Swift*/BAT[8](Oh et al. 2018; Barthelmy 2004) are reported. Here we report fluxes in energy range of 14-145 keV for *Swift*/BAT and an energy range of 17–60 keV for *INTEGRAL*. Note that these bands are largely equivalent as the flux above 60 keV is comparatively small for most sources, and the variability argument still applies.

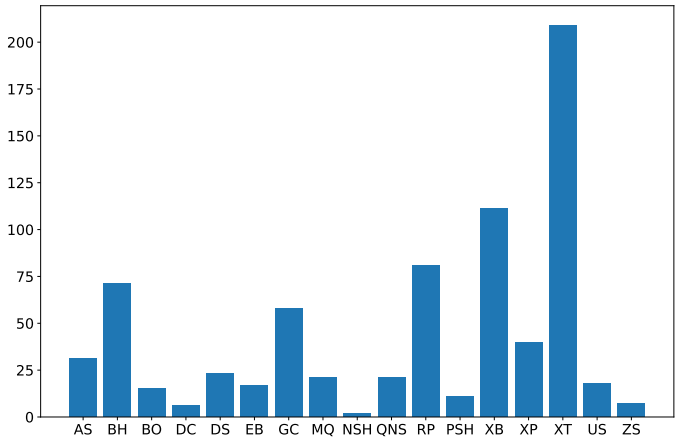

Fig. 1. Population of LMXBs of each type in the Galaxy.

Another key property provided by X-ray observations is the localization essential to identify or assess reliability of identified optical counterparts. We also include, therefore, information on the most accurate X-ray position available either from the literature or directly from soft (*Chandra*, *XMM-Newton* or *Swift*/XRT) and hard (*INTEGRAL*, *Swift*/BAT) catalogues as described in the next section.

2.3. Astrometry and identification of the optical counterparts

Considering that properties of XRBs are largely defined by properties of the donor star, the identification of the optical counterparts and characterization of their multi-wavelength properties is essential. Some of the LMXBs in the sample already have robustly identified optical counterparts, however, optical positions (as well as other optical data) reported in Liu07 and RK03 are in many cases outdated and not really accurate by modern standards. We therefore made an effort to update those to current astrometry using *Gaia* DR2, eDR3, DR3 catalogues (Gaia Collaboration et al. 2018; Bailer-Jones et al. 2018; Gaia Collaboration 2020; Bailer-Jones et al. 2021; Gaia Collaboration 2022)[9] and mid-IR *CatWISE*2020 catalogue[10](Marocco et al. 2021). To identify counterparts in these catalogues, we first checked whether the *Simbad* database already contained identified *Gaia* DR3[11](eDR3, DR2) and/or Two Micron All Sky Survey[12](2MASS, Skrutskie et al. 2006; Cutri et al. 2003b,a) counterparts. If this was not the case, we matched positions obtained from literature to *Gaia* DR3 (eDR3, DR2) using a match radius of 10″ and making sure that positions and magnitudes of the identified matches reported in the literature and observed by *Gaia* are consistent within uncertainties. In most cases this corresponded to the *Gaia* source closest to the literature position with a V band magnitude within 2 mag (obtained from the G magnitude reported by *Gaia*). We

[4] https://heasarc.gsfc.nasa.gov/W3Browse/xmm-newton/xmmssc.html
[5] https://vizier.cds.unistra.fr/viz-bin/VizieR-3?-source=IX/57/csc2master
[6] https://vizier.cds.unistra.fr/viz-bin/VizieR-3?-source=IX/58/2sxps
[7] https://vizier.cds.unistra.fr/viz-bin/VizieR-3?-source=J/A%2bA/545/A27
[8] https://heasarc.gsfc.nasa.gov/W3Browse/swift/swbat105m.html
[9] https://vizier.cds.unistra.fr/viz-bin/VizieR-3?-source=I/352
[10] https://vizier.cds.unistra.fr/viz-bin/VizieR?-source=II/365
[11] https://vizier.cds.unistra.fr/viz-bin/VizieR-3?-source=I/355
[12] https://vizier.cds.unistra.fr/viz-bin/VizieR?-source=II/246

note that most of the LMXBs are variable to some extent also in the optical band so an exact comparison would be impracticable. The threshold of 2 mag was determined empirically by inspecting the difference between the same band for sources whose *Gaia* counterpart was already known.

As mentioned earlier, some LMXBs have been classified as such only based on their X-ray properties, and have no uniquely identified optical counterparts in the literature. In most cases, these are relatively poorly studied sources (sometimes only detected once with X-ray monitors during an outburst). However, in some cases accurate X-ray positions obtained at a later time are available. For those objects we used *CXO*, *XMM-Newton*, or *Swift*/XRT positions (in order of preference). The search radius was set to match the full positional uncertainty (i.e., statistical plus systematic) reported in the respective X-ray catalogue. The final identification of plausible optical counterparts was done manually by inspection of the finding charts also released as part of the current catalogues and researching properties of tentative counterparts in the literature. In all cases where it was possible to identify a plausible counterpart we list is as such, however, the optical position is only assigned as primary if a unique counterpart is identified. All sources where this procedure was applied are flagged as tentative identification in the catalogue (1 in the tentative column).

2.4. Additional information

For all optical counterparts identified as described above, we include information on IR and/or optical magnitudes wherever it is possible. In particular we include *Gaia* G-band or V-band magnitudes in the optical band, near-IR photometry either from *2MASS* or Visible and Infrared Survey Telescope for Astronomy (*VISTA*, Emerson et al. 2006; Dalton et al. 2006) Variables in the Via Lactea (*VVV*) DR4 catalogue (VVV[13], Minniti et al. 2010) surveys, or from the literature. Finally, we include also magnitudes in the W1- and W2-bands reported in the *CatWISE*2020, *AllWISE* or *WISE* (in that order of preference) catalogues (Marocco et al. 2021; Cutri et al. 2021; Wright et al. 2010). In all cases we give the references to the source where the V-band, G-band, JHK, and *WISE* magnitudes are taken from the 'Vmag_Ref', 'Gmag_Ref', 'JHK_Ref' and 'WISE_Ref' columns, respectively. It should be noted that we mainly tried to include the optical/IR magnitudes during the quiescent state of the corresponding binary (to represent LMXB population in the state where it stays most of the time). However, in some cases "quiescent" magnitudes were not available. In this case we list magnitudes during the outburst, if any.

Besides more accurate positions and photometry, we have also included some additional information unavailable at the time of Liu07 and RK03 publications. For all LMXBs for which a *Gaia* counterpart was ultimately identified, we provide distance estimates from Gaia Collaboration (2022); Bailer-Jones et al. (2021); Anders et al. (2022); Bailer-Jones et al. (2018); Anders et al. (2019)[14]. If multiple distance estimates were available, the mean distance $\langle d \rangle$ was calculated by using the arithmetic mean on all available distance estimations linked to the given source. The range of possible distances being the lowest and highest estimations of all distance estimates for a given system (both from the literature and *Gaia*) is also reported and represents a conservative estimate of distance uncertainty. We note that the exact distance value estimated by each of the catalogues mentioned above can be obtained through cross-correlation of our catalogue with the respective database.

The spectral type of the counterpart is also of interest, so we attempted to include this information using the following sources: *Gaia* DR3, *SIMBAD*, and the general literature. We note that the list of X-ray pulsars maintained by Mauro Orlandini[15] was found to be useful source in this regard (and also for reported spin and orbital periods) and would like to acknowledge it here. For sources where the reported spectral type and corresponding reference were published before 2007, the spectral information in RK03 or Liu07 were used.

Finally, for convenience we also provide the X-ray absorption column density ($N_{\rm H}$) estimates, which might be relevant to estimate some additional LXMB properties such as X-ray to optical luminosity ratios in order to facilitate searches for new LMXBs with similar properties. We report values based either on *Swift*/XRT data Evans et al. (2020), or from those reported in the literature (all references are listed). In the absence of an X-ray column density estimate, we estimated them based on extinction in the optical band (using G-band absorption $A_{\rm G}$ from *Gaia* DR3, *StarHorse* and literature) and for X-ray fluxes (using $N_{\rm H}$, see below for details). In cases where one of the two ($N_{\rm H}$ or $A_{\rm G}$) was unknown, we calculated the other one through the $N_{\rm H}(A_{\rm G})$ relation reported by Foight et al. (2016).

3. Catalogue content and quality assurance

3.1. Description of the fields

The catalogue contains 348 entries, each of which corresponds to a single Galactic source. The objects are sorted by right ascension (the second column) in the increasing order. There are a total of 61 columns listing various parameters and corresponding references. The content and format of individual columns is described in detail in the Table B.1 in Appendix B.

3.2. Finding charts and problematic cases

For all sources we provide finding charts which consist of up to 6 different images ranging from near infra-red to hard X-rays as part of the catalogue. For the majority of the finding charts, we used the Hierarchical progressive surveys (HiPS, Fernique et al. 2015); only in the case of *Swift*/XRT did we use the SkyView Query. Both HiPS and SkyView offers the possibility to query their data automatically with Python. In case of HiPS, we used astroquery.hips2fits[16] package, and to access SkyView we used the astroquery.skyview[17] package. In the following, we will mention the used surveys and with their corresponding links as footnotes. The finding charts consist of up to 6 different surveys which we mention below, with their corresponding links as footnotes. In the top row we included, the image of the Visible and Infrared Survey Telescope for Astronomy (VISTA) Variables in the the Via Lactea (VVV[18]) DR4 catalogue (Minniti et al. 2010) or 2MASS[19] (in order of preference, left), an image of *unWISE*[20]

[13] http://vvvsurvey.org

[14] https://vizier.cds.unistra.fr/viz-bin/VizieR-3?-source=I/354/starhorse2021

[15] http://www.iasfbo.inaf.it/~mauro/pulsar_list.html

[16] https://astroquery.readthedocs.io/en/latest/hips2fits/hips2fits.html

[17] https://astroquery.readthedocs.io/en/latest/skyview/skyview.html

[18] http://alasky.cds.unistra.fr/VISTA/VVV_DR4/VISTA-VVV-DR4-J/

[19] http://alasky.cds.unistra.fr/2MASS/J/

[20] http://alasky.cds.unistra.fr/unWISE/W1/

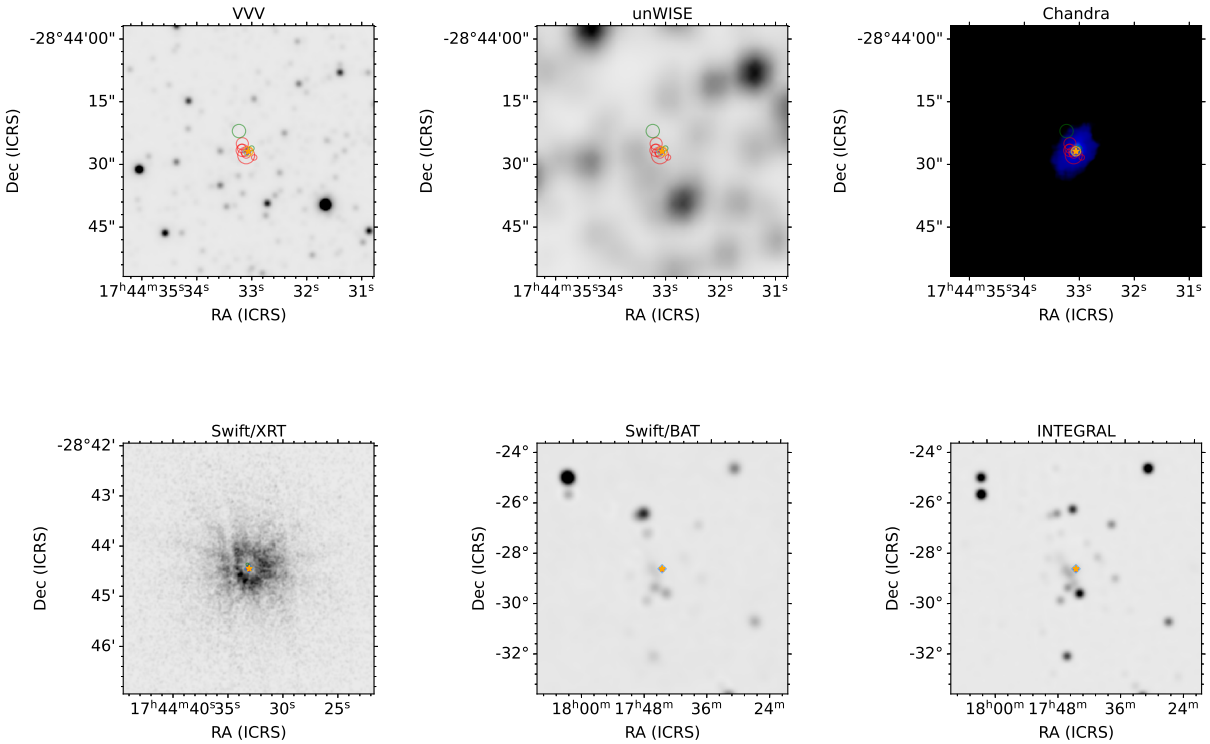

Fig. 2. Finding Chart of GRO J1744−28. The finding Charts are overlaid by markers and error circles to indicate observation of different instruments. A cyan cross indicates the position of the 2MASS-observation, an orange X the CatWISE-position, and a purple square the observation in *Gaia* DR3. The soft X-ray observations are only using the error circles to prevent overcrowding, the yellow circle is for *Chandra*, and the green one for *Swift*/XRT. A deep-pink pentagram together with an deep-pink error circle is used for *Swift*/BAT, and the lime-green triangle together with the corresponding circle indicates the INTEGRAL-observation. The red cross and the blue diamond are indicating the position reported by *SIMBAD* and in the Literature, respectively. An orange star indicates the position of the LMXB, which is used in this catalogue.

(Schlafly et al. 2019) in the middle and the RGB-image of either *Chandra*[21], *XMM-Newton*[22] or the Roentgensatellit (*ROSAT*[23], Truemper 1982; Boller et al. 2016; Voges et al. 1999) (in order of preference, right). In the bottom row, there is the soft X-ray image of *Swift*/XRT (SwiftXRTInt in astroquery.skyview) at the left corner, for hard X-rays *Swift*/BAT[24] images in the middle and *INTEGRAL*[25] images in the right corner. A 1 arcmin field of view was used for creation of the VVV, 2MASS, *unWISE*, *XMM-Newton*, and *Chandra* images. In case of *Swift*/XRT and *ROSAT*, we used a field of view of 5 arcmin and 15 arcmin, respectively. The field of view in case *Swift*/BAT and *INTEGRAL* was chosen to be 10°. In each case, the size of the region was chosen considering field of view and angular resolution of a given instrument. Every panel also shows coordinates and uncertainties of all detected sources within respective regions (position uncertainties are represented by error circles). A red cross indicates the position which is mentioned in *SIMBAD* for the Source, and a dodger-blue diamond for the coordinates which are described in the literature. The position of the source which is used in this catalogue is indicated with an orange star. In case of the soft X-ray instruments, the position of the observations is indicated by the error circles to prevent overcrowding, a golden circle indicates the *Chandra* position, a red circle *XMM-Newton*, a green circle *Swift*/XRT, and a navy-blue circle *ROSAT*. *Swift*/BAT and *INTEGRAL* are indicated as a deep-pink pentagon and lime-green triangle, respectively. In the optical band, we indicate *CatWISE* with an orange X, 2MASS with a cyan +, and *Gaia* DR3 data with purple square. As an example, Figure 2 shows the finding chart of GRO J1744−28. We note also that imaging in more bands with a catalogue overlay is available via the *Aladin lite* interface (Baumann et al. 2022) on the website hosting the catalogue[26].

Based on the visual inspection of the finding charts and literature research, several problematic cases have been identified (grouped by cause of the problem):

[21] https://cdaftp.cfa.harvard.edu/cxc-hips/
[22] http://skies.esac.esa.int/XMM-Newton/EPIC-RGB/
[23] http://alasky.cds.unistra.fr/RASS/
[24] http://cade.irap.omp.eu/documents/Ancillary/4Aladin/BAT_14_20/
[25] http://cade.irap.omp.eu/documents/Ancillary/4Aladin/INTEGRAL_17_60/
[26] http://astro.uni-tuebingen.de/~xrbcat

Table 1. List of tMSP candidates presented in our catalogue along with known tMSPs: XSS J12270−4859, IGR J18245−2452 and PSR J1023+0038.

Source Name	References⋆
1FGL J1417.7−4407 (J1417−4402 in RK03)	[1]
CXOGlb J183544.5−325939 (NGC 6652B)	[2]
4FGL J0427.8−6704	[3], [4]
4FGL J0407.7−5702	[5]
CXOGlb J174804.5−244641 (Terzan 5 CX1)	[6]
CXOU J110926.4−650224	[7], [8]
3FGL J1544.6−1125	[9], [10], [11]
4FGL J0540.0−7552	[12]
RX J1739.4−2942 (GRS 1736−297)	[13]

⋆ [1] Swihart et al. (2018), [2] Paduano et al. (2021), [3] Kennedy et al. (2020), [4] Li et al. (2020), [5] Miller et al. (2020), [6] Bahramian et al. (2018), [7] Coti Zelati et al. (2019), [8] Coti Zelati et al. (2021), [9] Bogdanov & Halpern (2015), [10] Britt et al. (2017), [11] Jaodand et al. (2021), [12] Strader et al. (2021), [12] Tetarenko et al. (2016),

- The X-ray source SAX J0840.7+2248, which is classified as a LMXB in Liu07, has been excluded from our catalogue. This transient is more likely to be the X-ray rich gamma ray burst GRB980429 rather than an XRB (Sidoli et al. 2007).
- SWIFT J0732.6−1330, which is listed as a LMXB in *SIMBAD*, also is not presented in our catalogue, due to the fact that the source is an intermediate polar (Butters et al. 2007).
- According to Peng & Shen (2021), the same scenario of polar nature applies to the LMXB candidate OGLE BLG511.6 25872. Thus, we do not include it in our catalogue.
- The X-ray transient Swift J061223.0+701243(.9), listed as LMXB in Liu07, could also be an intermediate polar (Butters et al. 2011). In this case the authors suggest that an LMXB nature "cannot be ruled out;', so the source can still be found in our catalogue but we urge caution when considering the classification of this source.
- V* V934 Cen, another *SIMBAD* LMXB, seems to possess no XRB nature (the corresponding link in *SIMBAD* for the suggested LMXB type does not provide any data regarding the source), so it is excluded from our catalogue as well.
- The same also goes for the binary TWA 22 (TWA 22AB), which is considered to be a LMXB in *SIMBAD* database. *SIMBAD* refers to Bonnefoy et al. (2009) as the source of the corresponding classification. However, authors in Bonnefoy et al. (2009) estimated the total mass of the binary to be about a $220 M_{\rm Jup}$, which is way too low for the XRB. Although the system emits X-rays via coronal activity (Stelzer et al. 2022) , it cannot be classified as an XRB.
- 4U 1745−203 (H 1745−203), is a source that is was considered as a separate LMXB, but it seems like this is just a counterpart of SAX J1748.9−2021 (NGC 6440 CX1), which has already been noted in Liu07.
- The same goes for bursting source MXB 1742−29. Following Martí et al. (2007) we consider it to be the counterpart of LMXB 1A 1742−294.
- AX J1620.1−5002 is also an X-ray transient which for a long time was considered to be separate XRB, but it is now strongly associated with bursting transient LMXB MAXI J1621−501 (Chenevez et al. 2018; Gorgone et al. 2018).
- 4U 0614+09 (4U 0614+091) is an ultra-compact LMXB with uncertain orbital period, which is only constrained to be greater that 1 h (Baglio et al. 2014). However, following Liu07 and RK03 in the catalogue, we provide a value of 51.3 min, based on Shahbaz et al. (2008).
- The nature of IGR J17404−3655 was not well constrained, since it was unclear rather the source is LMXB or HMXB, potentially BeXRB (Coleiro et al. 2013). However, Fortin et al. (2018) used K-band spectroscopy of the source, and revealed that the object is more likely to be a CV with a K3–5V donor star. Consequently, we made the decision to not include it.
- CXOGBS J174623.5−310550 is an accreting binary, which is presented in our catalogue. However, its exact classification as either LMXB or CV is still unknown (Torres et al. 2019).
- 1RXS J180431.1−273932 was, at first, considered as a symbiotic LMXB system (Nucita et al. 2007) hosting a neutron star with a M5 III donor star. However, based on optical observations, Masetti et al. (2012) excluded possible symbiotic LMXB nature and identified the source as a magnetic CV. Thus, despite the fact that 1RXS J180431.1−273932 is listed as symbiotic X-ray binary in Kuranov & Postnov (2015), we do not include it.
- Based on IR observations of 4U 1556−60 made by Revnivtsev et al. (2013), we associated for this source an optical counterpart *Gaia* DR3 583304229928809907 (see Table A.1), which lies well inside the position error circle of 0.″3. However, as it goes from provided parallax, the distance to this source should not exceed 1kpc (Bailer-Jones et al. 2021), which is 3–4 times less than distance estimations to 4U 1556−60 (Christian & Swank 1997; Grimm et al. 2002). We decided to leave this association with *Gaia* DR3 source, but keep in mind this discrepancy.
- For the source IGR J17597−2201 Walter et al. (2006) proposed 2MASS J17594556−2201435 as a potential counterpart. However, based on Very Large Telescope (VLT) observations conducted by Fortin et al. (2018), we can exclude this possibility.
- The persistent X-ray bright LMXB 4U 1624−49, seems to have incorrect coordinates and optical/IR associations in the *SIMBAD* database. The source was localized by Chandra with 0.″6 uncertainty at the position $\alpha_{\rm J2000.0}$ = $16^{\rm h}28^{\rm m}02\overset{\rm s}{.}825$, $\delta_{\rm J2000.0}$ = −49°11′54.″61 (Wachter et al. 2005), which corresponds to the known XMM source 2XMM J162802.8−491154, located ≈ 53.″ away from the position of 4U 1624−49 in *SIMBAD*. In our table, we provide the Chandra coordinates and uncertainty, as well as the K-band data obtained by Wachter et al. (2005). In the corresponding Chandra error circle there are no *Gaia*, *2MASS* or *CatWISE*2020 sources. We also label 2XMM J162802.8−491154 as an alternative name for 4U 1624−49, due to the fact that this name is not listed as identifier for this source in any other found database.
- The same scenario of incorrect *SIMBAD* associations with optical/IR archives applies to the LMXB GX 5−1(4U 1758−25). At the position provided by *SIMBAD* there is a bright star, located ≈ 200 pc away in the Gaia survey (Gaia Collaboration 2022), a distance which is totally inconsistent with another distance estimation (4.2–5.6 kpc, according to Clark 2018). The study Jonker et al. (2000) found an IR counterpart of the X-ray source at the position $\alpha_{\rm J2000.0}$ = $18^{\rm h}01^{\rm m}08\overset{\rm s}{.}222$,

$\delta_{J2000.0} = -25°04'42''.46$ with $0''.35$ uncertainty, leading to it being located $\approx 20''$ away from the position of GX 5−1 in *SIMBAD*. As in the case of 4U 1624−49 there are no *Gaia*, *2MASS* or *CatWISE*2020 counterparts. However, in the error circle we found a VVV source, from which the JHK magnitudes are provided in the table.

- We also decided to add the object named AX J1659.0−4208 as a LMXB in our catalogue. The source was detected during Advanced Satellite for Cosmology and Astrophysics (ASCA) Galactic plane survey (Sugizaki et al. 2001). At the time, source's X-ray flux was at the level of 6×10^{-12} erg/s/cm^2 (0.7 − 10 keV), but it's coordinates were not well constrained. Object's accurate position was then derived by Chandra, what led to identification of NIR counterpart by Revnivtsev et al. (2013). Authors suggested that the source is likely to be a symbiotic LMXB or a CV. However, based on high extinction towards this area, and distance estimations about 5-10 kpc (Revnivtsev et al. 2013), unabsorbed X-ray luminosity can be estimated (at very least) to be 10^{34} (most likely even 10^{35}) erg s^{-1}, i.e., significantly greater than expected from a typical CV. Hence, we suggest that the source is very likely a LMXB and it is added to our catalogue table.
- As for LMXB 4U 1728−34, it was supposed that the source has an orbital period of ∼ 11 min (Galloway et al. 2010), and this value is associated for the binary in RK03. However, analysis of other X-ray observations could not find further evidence for a periodic signal at 11 min. In the end, based on analysis of its type I X-ray burst, Vincentelli et al. (2020) stated that the orbital period should be much higher, probably ∼ 66 min or even $\gtrsim$ 2 hr. In the catalogue the value of 66 min is quoted, but keep in mind other possibilities.
- The X-ray source J2039−5617 (listed as [SMD2015] 3 in *SIMBAD*) is presented in the RK03 catalogue as a LMXB. However, due to a likely association with the known RB source 1FGL J2039.4−5621 (Salvetti et al. 2015), it is excluded from our catalogue.
- XB 1832−330 – a galactic cluster LMXB (in NGC 6652) was tentatively identified to have 43.6 min orbital period (Deutsch et al. 2000). But in Engel et al. (2012), the authors argue that the 43.6 minute candidate period is probably spurious and suggest a longer period (by a factor 3) of about 2.15 hr (this value is quoted in our catalogue).
- There is uncertainty about the orbital period of the tMSP candidate 4FGL J0540.0−7552. Strader et al. (2021) identified a consistent periodic signal at 2.7 h in their photometry. However, this signal could represent either the orbital period, half the orbital period (if due to ellipsoidal variations), or could even be spurious. We decided to keep the 2.7 h value of orbital period in our catalogue table for this source, but keep in mind other possibilities.

As was mentioned in the introduction, we decided to add all 3 known tMSP: XSS J12270−4859, IGR J18245−2452 and PSR J1023+0038 (all three are also listed in RK03 by the names J1227−4853, J1824−2452 and AY Sex, respectively). In addition, we include some tMSP candidates identified as such in the literature, which can be found in the Table 1 with following references. In the catalogue table itself, one can find a corresponding flag column named 'tMSP_Flag' (see Table B.1).

Several objects originally listed in the HMXB catalogue of Liu et al. (2006) were now moved to the current LMXB catalogue as their preferred classification changed:

- Karasev et al. (2008) proposed that XTE J1901+014 could be the first low-mass Fast X-ray transient, but the nature of the system is not completely clear until today. However, according to Sato et al. (2019) it appears to be more similar to a LMXB, hence it is included in our LMXB catalogue.
- Chaty et al. (2008) classified IGR J16358−4726 as an HMXB, however, this classification was revoked by Nespoli et al. (2010) and now the object is considered to be a Symbiotic X-ray binary which we consider to be a LMXB sub-class based on the typical donor mass.
- The situation is similar for IGR J17407−2808. The source was first classified as part of a Supergiant Fast X-ray Transients (Sguera et al. 2006, SFXT;), which are all HMXBs. However, subsequent works (Heinke et al. 2009; Greiss et al. 2011) ruled out the presence of a supergiant companion, and showed that a LMXB with F-type dwarf is more likely to be the case. Kaur et al. (2011) also found that a few days after the outburst, the IR counterpart was one magnitude brighter. Such a behavior is more expected during the LMXB outburst due to the exposure of the optical component to the X-rays emitted by the compact object.
- With the de-reddened magnitudes of their observations in the JHK-bands and under black-body spectrum assumption, Kaur et al. (2009) estimated the distance of SAX J1452.8−5949. This ruled out the possibility of a HMXB due to the fact that the system would be an extra-galactic source in this case. They concluded that the binary system must have a low-mass companion and therefore is either a LMXB or an Intermediate Polar (accreting magnetized white dwarf, IP). Therefore, we consider the source as an LMXB candidate.
- It has been unclear for some time whether 4U 1807−10 is a HMXB or a LMXB. However, based on the ratio of spin and orbital periods (Blay et al. 2008), as well as the fact that the system shows type I X-ray bursts (Chelovekov et al. 2017), we conclude that the LMXB origin is more likely to be the case, despite the fact that 4U 1807−10 is marked as a HMXB-candidate in Blay et al. (2008), and thus we add 4U 1807−10 to our LMXB catalogue.

Along with that, there is one source that does present in both of our catalogues, in this one, and in the one dedicated to HMXB (Neumann et al. 2023). This happened due to the presence of conflicting results and absence of any final decision on the origin nature of the source:

- Since its discovery, Cir X−1 was often referred to as a LMXB, until Heinz et al. (2013) could determine the age of the system to be about 4500 years. In addition, according to Jonker et al. (2007), the system contains an A0 to B5 type supergiant companion. However, Cir X−1 has also shown type I X-ray bursts (Tennant et al. 1986), which indicates that the source is a LMXB. Possible LMXB origin nature is also supported by the fact that companion star itself in Cir X−1 still cannot be unambiguously detected at optical wavelengths. Johnston et al. (2016) concluded that the donor can be: 1) an unevolved low mass star, or 2) a giant star that is still recovering from the impact of the supernova blast that happened less than 5000 years ago. Taking into account all this obscurity around Cir X−1's nature, we decided to add it to both LMXB and HMXB catalogues.

Several objects do actually have tentative or known optical counterparts in the literature but could not be found automatically through the procedure outlined above. For those objects, the literature was searched manually. In some cases optical, IR, or radio precise coordinates were available and we used them to find corresponding counterparts in *Gaia* DR3, 2MASS, etc. All solid

cross-matches and their coordinates were added to the catalogue. Additionally, identifications by Arnason et al. (2021) proved to be useful so these shall be considered as the main references for the cases marked in the Table A.1 in Appendix A, which lists all sources with optical/IR counterparts found, except those listed in *SIMBAD*.

As mentioned previously, several objects included in RK03 and Liu07 have been removed from our catalogue. Sometimes this was necessary because objects reported as independent in RK03 and Liu07 represented the same source (in either of the catalogues). This was mainly due to large positional uncertainties at the time of the catalogue compilation, or in some cases because the objects are extragalactic. In the case of the former, we include only the element from the pair in our LMXB list with the most used name, omitting the other, and summing up all known data. In the extragalactic origin scenario, the corresponding source is removed as we only consider Galactic LMXBs. Our initial source list was, therefore, modified as following:

- The relatively bright source 2A 0521−720, which is more known as LMC X−2, is located (as it could be suggested from the name) in the LMC. Since we consider only Galactic objects, we exclude it from our catalogue.
- This goes for RX J0532.7−6926, i.e. it is also not included in the current catalogue.
- The first objects AX J1745.6−2901 and 1A 1742−289 reported by Liu07 actually correspond to the same source, and since the name "AX J1745.6−2901" is more common to use, we combine information regarding the two from Liu07 under this name.
- The second similar case is 1E 1743.1−2852 and SAX J1747.0−2853, so we did the same giving the most popular name to the source, SAX J1747.0−2853.

3.3. Summary of other differences with respect to the Liu07 and RK03 catalogues

In addition to the problematic cases described above, and overall expansion of the sample, several other changes have been made compared to Liu07 and RK03:

- We homogenised the energy ranges for reported X-ray fluxes. Liu07 used an energy range between 2–10 keV for most sources, but in some cases the actual energy range was different and it was not trivial to identify such cases. We now quote soft and hard X-ray fluxes in well defined energy ranges separately.
- Furthermore, for most cases Liu07 only reported the maximal value of X-ray flux in units of Jy, now we report flux ranges in two energy bands in more commonly used cgs erg s^{-1} cm^{-2} units (equivalent to mW $m^{=2}$ preferred by the *VizieR* database), which makes more sense for X-ray sources.
- We increased the number of flags used to characterize source properties from 11 in Liu07 to a total of 17 in our case to better reflect various phenomenological features reported in the literature.
- Hydrogen column density, all IR data (WISE and 2MASS), BP-RP colour, optical Gaia data, and G-band extinction are new fields introduced in this version of the catalogue.
- We include up to six finding charts as part of the catalogue (from near-infrared images to hard X-ray bands), instead of a reference for a finding chart.
- Finally, the total number of objects included in the catalogue increased from 206 (Liu07 and RK03 combined) to 348, which represents a 72% increase in catalogue size.

4. Summary and conclusions

In this paper, we present a new LMXB catalogue which provides an up-to-date census of known LMXBs in the Galaxy with a variety of corresponding multi-wavelength information extracted from current optical/near-IR surveys. In total, the catalogue contains 348 sources and has 61 columns. A description of the columns is presented in Table B.1. The full version of the catalogue can be obtained through *VizieR*, as well as on a dedicated website[27]. We ask authors who use our catalogue in their research, to refer to us by citing this article, as well as by referring to the website link in either the acknowledgments or a footnote.

We would like to emphasize here that the origin of some of the sources listed in the catalogue has not yet been fully certain. Some sources have only been tentatively classified as LMXBs due to the similarity of their X-ray properties to those of the systems identified, with no counterparts found in other bands. Such objects should be treated with caution in view of all the further work and are clearly marked in the catalogue (field 6).

Along with this article, a new similar catalogue of HMXBs is being published Neumann et al. (2023). We hope that both catalogues will be useful tools for future studies which include (but are not limited to) population studies of various types of X-ray emitting objects (especially XRBs), search for new XRBs in ongoing and upcoming surveys, classification of unidentified X-ray sources, and as training data-sets for machine learning classification algorithms (Yang et al. 2021, 2022). In particular, this can be relevant in the context of the ongoing analysis of *eRosita* survey data which is expected to substantially increase the number of known XRBs (Doroshenko et al. 2014). We plan, therefore, to update our catalogues to the best of our ability to keep the ever-increasing census of the Galactic LMXBs up to date and accessible to the community.

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Appendix A: optical/IR counterparts

Table A.1. Identified archive Optical/IR counterparts of LMXBs.

Source name	*Gaia* DR3	*2MASS*	*CatWISE*2020
	Based on optical/IR/radio follow-ups:		
MAXI J0556−332	2890346074897001216		
4FGL J0427.8−6704	4656677385699742208	J04274958−6704350	J042749.64−670435.0
IGR J17494−3030	4056028099172996352		
1FGL J1417.7-4407	6096705840454620800	J14173057−4402574	J141730.57−440257.5
XTE J1637−498	5940421734427982336	J16370267−4951401	
MAXI J1807+132	4497207964419829632		
3A 1837+049	4283919201304278912	J18395759+0502113	J183957.57+050210.5
MAXI J1828−249	4076998775244833280		
XTE J1810−189	4095486509152850176	J18102033−1904136	
1RXS J180408.9−342058	4042163562572848384		
IGR J17091-3624	5976921951382731520		J170907.75−362425.0
IGR J17585−3057	4044163406621956992		J175829.80−305702.3
4U 1543−624	5826501373348972288		
Swift J1858.6−0814	4203799300867262720		
MAXI J1305−704	5843823766718594560		J130655.74−702704.2
IGR J17329−2731	4061336747511224704	J17325067−2730015	J173250.54−273003.4
IGR J16358−4726		J16355369−4725398	J163553.75−472541.0
XMMU J174445.5−295044		J17444541−2950446	J174445.43−295044.5
IGR J17454−2919		J17452768−2919534	
4U 1705−250	4112450294268643456		
4FGL J0540.0−7552	4648562676357022208		J054001.80−755419.7
3FGL J1544.6−1125	6268529198286308224		J154439.38−112804.5
CXOU J110926.4−650224	5240167590731178624		J110926.21−650227.1
4FGL J0407.7−5702	4682464743003293312		J040731.65−570025.1
1RXH J173523.7−354013	5974787971132982144		
IGR J16287−5021	5934583950467938304		
4U 1556−60	5833042299288099072		
EXO 1846−031	4258794192383316864	J18491710−0303559	J184917.08−030355.3
AX J1735.8−3207	4055019091071763712	J17354627−3207099	
Swift J2037.2+4151		J20370560+4150051	J203705.60+415005.2
	Based on Arnason et al. (2021):		
GRO J1655−40	5969790961312131456	J16540014−3950447	J165400.13−395044.7
SWIFT J061223.0+701243	1107229825742589696		J061222.63+701243.1
1A 1246−588	6059778089610749440		J124939.17−590516.3
MXB 1659−29	6029391608332996224		
SAX J1711.6−3808	5973177495780065664	J17113714−3807073	J171137.14−380707.4

Table A.1 – continued

Source name	*Gaia* DR3	*2MASS*	*CatWISE*2020
4U 1724−307	4058208396397618688	J17273315−3048076	J172733.28−304809.0
EXO 1747−214	4118590585673834624		
4U 1755−33	4042473487415175168		
HETE J1900.1−2455	4074363039644919936		
4U 1915−05	4211396994895217152		
XTE J1901+014	4268294763113217152		

Appendix B: catalogue format

Table B.1. Definition of columns in the LMXB catalogue. In total the catalogue contains 61 columns.

№	Column name	Unit	Description
1	'Name'		Object name, which is the most common name in the literature
2	'RAdeg'	deg	Right Ascension in degrees (ICRS).
3	'DEdeg'	deg	Declination in degrees (ICRS).
4	'PosErr'	arcsec	Positional error in arcseconds.
5	'Coord_Ref'		The source where the object's position is taken from.
6	'GLON'	deg	Galactic longitude in degrees.
7	'GLAT'	deg	Galactic latitude in degrees.
8	'Xray_Type'		List of the X-ray types assigned to the object. For more information see Sect. 2.1.
9	'Porb'	day	Orbital period of the binary system in days.
10	'Ppulse'	s	Pulsation period (spin) of the binary in seconds.
11	'Alt_Name'		Most frequently used alternative name.
12	'SpType'		Spectral type of the optical counterpart.
13	'Vmag'	mag	Optical magnitude in V-band according to SIMBAD database and literature.
14	'e_Vmag'	mag	Corresponding magnitude's error in V-band.
15	'Gaia_DR3_ID'		Name in Gaia DR3(eDR3) catalogue.
16	'Gmag'	mag	Optical magnitude in G-band according to a Gaia's catalogue or literature.
17	'e_Gmag'	mag	Corresponding magnitude's error in G-band.
18	'BP-RP'	mag	BP-RP colour.
19	'2MASS_ID'		Name in 2MASS catalogue.
20	'Jmag'	mag	IR magnitude in J-band according to 2MASS or literature.
21	'e_Jmag'	mag	Corresponding magnitude's error in J-band according to 2MASS or literature.
22	'Hmag'	mag	IR magnitude in H-band according to 2MASS or literature.
23	'e_Hmag'	mag	Corresponding magnitude's error in H-band according to 2MASS or literature.
24	'Kmag'	mag	IR magnitude in K-band according to 2MASS or literature.
25	'e_Kmag'	mag	Corresponding magnitude's error in K-band according to 2MASS or literature.
26	'WISE_ID'		Name in CatWISE, AllWISE or WISE catalogue.
27	'W1mag'	mag	IR magnitude in W1 WISE band.
28	'e_W1mag'	mag	Corresponding magnitude's errorin W1 WISE band.
29	'W2mag'	mag	IR magnitude in W2 WISE band.
30	'e_W2mag'	mag	Corresponding magnitude's error in W2 WISE band.
31	'N_H'	10^{22}cm^{-2}	Neutral hydrogen column density.
32	'MinSoftFlux'	10^{-12}erg/s/cm^2	Minimum flux from a source in soft X-ray.
33	'MaxSoftFlux'	10^{-12}erg/s/cm^2	Maximum flux from a source in soft X-ray.
34	'Soft_Xray_Var		Ratio of maximal soft X-ray flux and minimal soft X-ray flux.
35	'MinHardFlux'	10^{-12}erg/s/cm^2	Minimum flux from a source in hard X-ray.
36	'MaxHardFlux'	10^{-12}erg/s/cm^2	Maximum flux from a source in hard X-ray.
37	'Hard_Xray_Var'		Ratio of maximal hard X-ray flux and minimal hard X-ray flux.
38	'AG'	mag	G-band absorption A_G.
39	'Mean_Dist'	pc	Mean estimate of the distance to the binary system.
40	'Low_Dist'	pc	The lowest (minimum) estimate of the distance to the binary system.
41	'High_Dist'	pc	The highest (maximum) estimate of the distance to the binary system.

Table B.1 – continued

№	Column name	Unit	Description
42	'Incl'	deg	Binary system's inclination
43	'Mx'	$M_\odot$	Mass of the compact object.
44	'Mopt'	$M_\odot$	Mass of the optical counterpart.
45	'Mx/Mopt'		The ratio between the mass of the compact object and the donor star's mass.
46	'B-V'	mag	B-V color index.
47	'E(B-V)'	mag	E(B-V) color excess.
48	'tMSP_Flag'		tMSP flag, which can take one of the two values, indicating that the source is: 1 — one of the three solidly considered tMSPs. 2 — a tMSP candidate.
49	'Liu07_IDX'		Ordinal number of the source in the table of Liu07 LMXB catalogue.
50	'RK03_IDX'		Ordinal number of the source in the table of RK03 LMXB catalogue.
51	'Orb_Ref'		Orbital period origin reference.
52	'Pulse_Ref'		Spin (pulsation) period of the NS origin reference.
53	'Spect_Ref'		Optical star's spectral type origin reference.
54	'Vmag_Ref'		V-band magnitude origin reference.
55	'Gmag_Ref'		G-band magnitude origin reference.
56	'JHK_Ref'		JHK information origin reference.
57	'WISE_Ref'		Reference to the WISE IR catalogue used (CatWISE, AllWISE or WISE).
58	'N_H_Ref'		$N_{\rm H}$ value origin reference.
59	'AG_Ref'		G-band absorption $A_{\rm G}$ origin reference.
60	'Dist_Ref'		Distance estimations origin reference.
61	'Mass_Ref'		Masses estimations origin reference.